

**MISSOURI DEPARTMENT OF ELEMENTARY AND SECONDARY EDUCATION  
CERTIFICATION REQUIREMENTS FOR  
SECONDARY EDUCATION (GRADES 9-12)**

**I. GENERAL REQUIREMENTS:**

- A. A baccalaureate degree from a college or university having a teacher education program approved by the Missouri Department of Elementary and Secondary Education;
- B. Must have recommendation of designated official for teacher education in the college or university;
- C. Must have a grade point average of 2.5 on a 4.0 scale overall and in the major area of study;
- D. Must complete the content knowledge or specialty area test designated by the State Board of Education with a score equal to or greater than the Missouri qualifying score. If no content knowledge or specialty area test is designated for the area of concentration, completion of the Principles of Learning and Teaching: Grades 9-12 test is required with a score equal to or greater than the Missouri qualifying score;
- E. Completion of professional requirements as determined by the recommending college or university, which may exceed these minimum requirements; and
- F. Individuals who completed their teacher education program outside of the United States shall provide documentation of completion of course work in the following:
  - 1. English Composition, two (2) courses, each a minimum of two (2) semester hours;
  - 2. U.S. History, three (3) semester hours; and
  - 3. U.S. Government, three (3) semester hours.

**II. PROFESSIONAL REQUIREMENTS:** A minimum requirement of twenty-six (26) semester hours in professional education as follows:

**A. Foundations of Teaching** (Minimum requirement of eight (8) semester hours):

- 1. **The Pupil/Society**--A minimum of six (6) semester hours with knowledge acquired and competency developed to the satisfaction of the teacher preparation institution in the following content areas:
  - a. Adolescent Growth and Development (Physical-Mental-Social);
  - b. Adolescent Behavior Management Techniques;
  - c. Psychology of Learning (must include adolescent learning);
  - d. Adolescent Interaction with Others; and
  - e. \*Psychology and/or Education of the Exceptional Child (including the Gifted); and
- 2. **The School/Society**--A minimum of two (2) semester hours with knowledge acquired and competency developed to the satisfaction of the teacher preparation institution in the following content areas, including multi-cultural aspects:
  - a. Legal Foundations of Education;
  - b. Historical Foundations of Education;
  - c. Philosophical Foundations of Education; and
  - d. Sociological Foundations of Education; and

**B. Secondary Methods and Techniques** (Minimum requirement of eight (8) semester hours):

A minimum of eight (8) semester hours with knowledge acquired and competency developed to the satisfaction of the teacher preparation institution in the following content areas:

- 1. \*Basic Reading Techniques for Secondary Teachers;
- 2. Instructional Strategies for Secondary Teachers;
- 3. \*Curriculum, Methods, and Techniques in each subject area specialty;
- 4. Measurement and Evaluation; and
- 5. Microcomputer Applications in Education; and

**C. Clinical Experiences** (Minimum requirement of ten (10) semester hours):

Certification in grades 9-12 should include clinical experience at the secondary level. A minimum of two (2) semester hours prior to student teaching\*\* and a minimum of eight (8) semester hours

*\*Denotes minimum of two (2) semester hours required.*

*\*\*Required separate verification on transcripts; may be two (2) separate courses.*

of student teaching in grades 9-12 is required, except that K-9 or K-12 certification must also include K-6 experience in student teaching. A fully certificated elementary or middle school teacher with two (2) or more years of elementary or middle school teaching may satisfy this requirement through the completion of a two (2) or more semester hour practicum at the secondary level.

### III. SUBJECT MATTER REQUIREMENTS AS SPECIFIED FOR SPECIFIC AREA(S) OF CERTIFICATION

A. AGRICULTURE EDUCATION		GRADES 9-12
1. General Requirements:		
Bachelor's of Science degree in Agriculture or an equivalent degree or Bachelor's of Science in Education degree with a major in Agriculture.		
2. Subject Matter Requirements:		
a. Technical Agriculture		
The following six (6) areas will total thirty (30) semester hours:		
1) Animal Science .....	3	
2) Agronomy .....	3	
3) Agricultural Business .....	3	
4) Agricultural Economics .....	3	
5) Agricultural Mechanics .....	3	
6) Horticulture .....	3	
7) Elective from above .....	0-12	
8) Elective from the following suggested areas: .....	15	
Forestry, Natural Resources, Agriculture Journalism and Integrated Pest Management		
MINIMUM TOTAL SEMESTER HOURS .....		45
b. A total of at least eight (8) semester hours in professional vocational education courses, including the following areas:		
1) Methods of teaching vocational agriculture		
2) Program planning		
3) Developing and supervising occupational experience programs		
a) Ownership (Entrepreneurship)		
b) Placement		
4) Developing and using instructional materials and teaching aids		
5) Supervising student organizations		
6) Teaching agricultural mechanics		
7) Planning and conducting adult programs for young and adult farmers		
NOTE: Specialized professional vocational education course work in the area of Agriculture Education may be recognized as meeting the "Curriculum, Methods, and Techniques in Subject Area Specialty" within the professional education requirement for all secondary teachers and the balance of the specialized professional vocational education course work for teachers of Agriculture Education be viewed as specialized requirements beyond the general requirements.		

<b>B. ART</b>	<b>GRADES K-12</b>	<b>GRADES K-9*</b>	<b>GRADES 9-12</b>
1. Design--Composition .....	2	2	2
2. Two-Dimensional Art (seven (7) semester hours minimum)			
a. Drawing .....	3	3	3
b. Painting .....	2	2	2
c. Graphics (such as printmaking, photography, and serigraphy) .....	2	2	2

\*Teachers must be certificated in another elementary, middle school, or secondary teaching field.

<b>B. ART (continued)</b>	<b>GRADES K-12</b>	<b>GRADES K-9*</b>	<b>GRADES 9-12</b>
3. Three-Dimensional Art (seven (7) semester hours minimum)			
a. Ceramics .....	3	3	3
b. Sculpture .....	2	2	2
c. Fibers (such as weaving, macramé, and fiber sculpture) .....	2	2	2
d. History, Theory, Criticism in the Visual Arts.....	3	3	3
4. Art for Elementary Grades.....	2	2	0
5. Electives .....	9	0	11
<b>MINIMUM TOTAL SEMESTER HOURS.....</b>	<b>30</b>	<b>21</b>	<b>30</b>

*\*Teachers must be certificated in another elementary, middle school, or secondary teaching field.*

<b>C. BUSINESS EDUCATION</b>	<b>GRADES 9-12</b>
1. <b>General Requirements:</b> Bachelor's of Science degree in Business Education.	
2. <b>Subject Matter Requirements:</b>	
a. Technical Business	
1) Keyboarding .....	2
2) Accounting.....	3
3) Economics.....	2
4) Business/Consumer Related Law .....	2
5) Business Communications .....	2
6) Management .....	2
7) Marketing.....	2
8) Computer/Emerging Technology .....	9
9) Electives .....	0-6
<b>MINIMUM TOTAL SEMESTER HOURS.....</b>	<b>30</b>
b. A total of at least eight (8) hours in professional education courses, including the following areas:	
1. Methods of Teaching Business Education	
2. Curriculum Development for Business Education	
3. Implementing Business Education Programs	
c. One (1) year or two thousand (2,000) hours of approved occupational experience or appropriate internship is required. The approval is determined by the nature of employment in a business occupation.	

<b>D. BUSINESS EDUCATION—COOPERATIVE EDUCATION</b>	<b>GRADES 9-12</b>
1. <b>General Requirements:</b> Bachelor's of Science degree in Business Education.	
2. <b>Subject Matter Requirements:</b>	
a. Technical Business	
1) Keyboarding.....	2
2) Accounting.....	3
3) Economics .....	2
4) Business/Consumer Related Law .....	2
5) Business Communications .....	2
6) Management.....	2
7) Marketing.....	2

<b>D. BUSINESS EDUCATION—COOPERATIVE EDUCATION (continued)</b>	<b>GRADES 9-12</b>
8) Computer/Emerging Technology .....	9
9) Electives .....	0-6
<b>MINIMUM TOTAL SEMESTER HOURS.....</b>	<b>30</b>
b. A total of at least ten (10) hours in professional education courses, including the following areas:	
1) Methods of Teaching Business Education	
2) Curriculum Development for Business Education	
3) Implementing Business Education Programs	
4) Coordination of Cooperative Education	
c. Two (2) years or four thousand (4,000) hours of approved occupational experience or appropriate internship is required. The approval is determined by the nature of employment in a business occupation.	
<b>E. COOPERATIVE EDUCATION</b>	<b>GRADES 9-12</b>
1. <b>General Requirements:</b>	
Bachelor's of Science in Education degree.	
2. A total of at least eight (8) hours in professional education courses, including the following areas:	
a. Methods of Teaching Marketing Education	
b. Curriculum Development for Marketing Education	
c. Coordination of Cooperative Education	
3. Two (2) years or four thousand (4,000) hours of approved occupational experience or appropriate internship is required. The approval is determined by the nature of employment in a business occupation.	
<b>F. DANCE</b>	<b>GRADES K-12</b>
1. Dance Electives with appropriate distribution in the subject area .....	30
<b>MINIMUM TOTAL SEMESTER HOURS.....</b>	<b>30</b>
<b>G. DRIVER EDUCATION*</b>	<b>GRADES 9-12</b>
1. Introduction to Safety Education.....	3
2. Driver Task Analysis .....	3
3. Developing Vehicle Operation Skills and Competencies .....	3
4. Developing Classroom Knowledge.....	3
<b>MINIMUM TOTAL SEMESTER HOURS.....</b>	<b>12</b>
<i>*Teacher must be certificated in another elementary, middle school, or secondary teaching field</i>	
<b>H. ENGLISH</b>	<b>GRADES 9-12</b>
1. Composition and Rhetoric .....	12
(Must include a course in the teaching of writing)	
2. Study of the English Language.....	5
(Must include modern grammar, history of the language, and/or dialects)	
3. American Literature .....	5
(must include at least one (1) major unit or module in literature for adolescents and one (1) in literature of ethnic groups*)	
4. English and/or World Literature .....	5
5. Elective English Credit.....	3
<b>MINIMUM TOTAL SEMESTER HOURS.....</b>	<b>30</b>
<i>*Ethnic groups include, but are not limited to, Afro-, Chinese-, Japanese-, Italian-, East European-, Jewish, Mexican-American, American Indian, or Puerto Rican.</i>	

<b>I. FAMILY AND CONSUMER SCIENCES</b>	<b>GRADES B -12</b>
1. Foundations of Family and Consumer Sciences Education.....	3
2. Nutrition and Wellness.....	6
3. Family and Consumer Resource Management.....	9
4. Human Development and Parenting .....	6
5. Family and Interpersonal Skills.....	6
6. Electives (content area).....	3
<b>MINIMUM TOTAL SEMESTER HOURS.....</b>	<b>33</b>

## **J. FOREIGN LANGUAGE**

**GRADES K-12:** Thirty (30) semester hours in the Foreign Language to be taught, or twenty-seven (27) semester hours plus two (2) or more earned units of high school credit in that language.

**GRADES K-9\*:** Twenty-one (21) semester hours in the Foreign Language to be taught, or eighteen (18) semester hours plus two (2) or more earned units of high school credit in that language.

In addition to an understanding and appreciation of the foreign culture and civilization, the prospective teacher will demonstrate, to the satisfaction of the degree-granting institution, proficiency in the areas of listening comprehension, speaking, reading, and writing.

*\*Teachers must be certificated in another elementary, middle school, or secondary teaching field.*

<b>K. HEALTH</b>	<b>GRADES K-12</b>	<b>GRADES K-9*</b>	<b>GRADES 9-12</b>
1. Human Anatomy-Physiology.....	3	3	3
2. Nutrition.....	2	2	2
3. Drug Education .....	2	2	2
4. Personal Health .....	2	2	2
5. Mental Health.....	2	2	2
6. Family Life/Sex Education.....	3	3	3
7. Safety and First Aid .....	2	2	2
8. Community Health.....	2	2	2
9. Methods in Health K-9.....	2	2	0
10. Electives in Health (may include additional hours from above) .....	12	1	12
<b>MINIMUM TOTAL SEMESTER HOURS .....</b>	<b>32</b>	<b>21</b>	<b>30</b>

*\*Teachers must be certificated in another elementary, middle school, or secondary teaching field.*

<b>L. INDUSTRIAL TECHNOLOGY</b>	<b>GRADES 9-12</b>
1. Communication Technology .....	7
2. Energy and Power .....	7
3. Materials and Processes Technology.....	7
4. Organization and Administration .....	5
5. Electives .....	10
<b>MINIMUM TOTAL SEMESTER HOURS.....</b>	<b>36</b>

<b>M. JOURNALISM</b>	<b>GRADES 9-12</b>
1. News Writing and Reporting .....	3
2. Editing .....	3
3. Communications Law .....	3
4. Mass Communications Theory .....	3
5. Scholastic Publications .....	3
6. Electives: Photography, Graphics, Advertising, Broadcasting, History of Journalism, Mass Media and Society, News Media Experience, and other related areas .....	15
<b>MINIMUM TOTAL SEMESTER HOURS.....</b>	<b>30</b>

**NOTE:** It is recommended that news media experience (e.g., professional news media, college publications, etc.) be included in the program on a credit or noncredit basis.

<b>N. LIBRARY MEDIA SPECIALIST</b>	<b>GRADES K-12</b>
1. Introductory Seminar .....	1
2. Library Media Administration .....	3
3. Selection and Acquisition .....	3
4. Cataloging .....	3
5. Reference .....	3
6. Materials Production .....	3
7. Children's or Adolescent Literature .....	2
8. Information Technologies .....	3
9. Utilization and Integration .....	3
10. Practicum .....	2
11. Electives .....	4
<b>MINIMUM TOTAL SEMESTER HOURS .....</b>	<b>30</b>

<b>O. MARKETING EDUCATION</b>	<b>GRADES 9-12</b>
1. <b>General Requirements:</b> Bachelor's of Science in Education degree with an emphasis in Marketing.	
2. <b>Subject Matter Requirements:</b>	
a. Technical Marketing Education	
1) Management or Business Administration .....	3
2) Economics .....	2
3) Electives from Business, Management, or Entrepreneurship .....	0-5
4) Marketing .....	15
Suggested areas: Distribution, Financing, Marketing-information Management, Promotion, Selling, Product/Service Management, International Marketing, E- commerce Marketing.	
<b>MINIMUM TOTAL SEMESTER HOURS.....</b>	<b>25</b>
b. A total of at least eight (8) hours in professional education courses, including the following areas:	
1) Methods of Teaching Marketing Education	
2) Curriculum Development for Marketing Education	
3) Coordination of Cooperative Education	
c. Two (2) years or four thousand (4,000) hours of approved occupational experience or appropriate internship is required. The approval is determined by the nature of employment in a business occupation.	

<b>P. MATHEMATICS</b>	<b>GRADES 9-12</b>
1. Calculus and Analytical Geometry.....	8
2. Algebraic Structures .....	3
3. Geometry .....	3
4. Computer Science .....	2
5. Electives from the above course work.....	4
<b>Sub-total Semester Hours .....</b>	<b>20</b>
6. A minimum of ten (10) semester hours from at least 3 (three) areas of Mathematics such as the following:	
a. History of Mathematics.....	2-3
b. Structure of the Real Number System .....	2-3
c. Number Theory .....	2-3
d. Completion Calculus Sequence .....	2-5
e. Probability and Statistics .....	2-3
f. Computer Science.....	2-5
g. Math for Exceptional Children .....	2-3
h. Linear Algebra .....	2-3
<b>Sub-total Semester Hours .....</b>	<b>10</b>
<b>MINIMUM GRAND TOTAL SEMESTER HOURS.....</b>	<b>30</b>

<b>Q. MUSIC</b>	<b>GRADES K-12</b>
<b>1. VOCAL/CHORAL</b>	
a. Theory .....	8
b. Beginning Conducting.....	2
c. History/Literature Music .....	4
d. Piano (or proficiency) .....	2
e. Choral Arranging .....	2
f. Applied Voice .....	6
g. Choral Techniques.....	2
h. Advanced Choral Conducting.....	2
i. Choral Literature .....	2
j. Choral Ensemble.....	2
k. Methods/Techniques of Teaching Elementary School Music .....	2
(to include an introduction to early childhood choral literature and musical instruments)	
l. Methods/Techniques of Teaching Middle/Secondary School Music .....	2
<b>MINIMUM TOTAL SEMESTER HOURS.....</b>	<b>36</b>
<b>2. INSTRUMENTAL</b>	
a. Theory .....	8
b. Beginning Conducting.....	2
c. History/Literature Music .....	4
d. Piano (or proficiency) .....	2
e. Methods/Techniques (strings, brass, woodwinds, percussion).....	6
f. Applied major instrument .....	4
g. Instrumental ensemble .....	2
h. Advanced Instrumental Conducting .....	2
i. Instrumentation/arranging.....	2
j. Methods/Techniques of Teaching Middle/Secondary School Music .....	2

<b>Q. MUSIC (continued)</b>		<b>GRADES K-12</b>
k. Methods/Techniques of Teaching Elementary School Music ..... 2 (to include an introduction to early childhood choral literature and musical instruments)		2
<b>MINIMUM TOTAL SEMESTER HOURS</b> .....		<b>36</b>
<b>3. VOCAL/CHORAL CERTIFICATE</b>		
a. Instrumental Music K-12 Certificate		
b. Choral Arranging .....		2
c. Applied Voice .....		4
d. Choral Techniques .....		2
e. Advanced Choral Conducting.....		2
f. Choral Literature.....		2
g. Choral Ensemble .....		2
<b>MINIMUM TOTAL SEMESTER HOURS</b> .....		<b>14</b>
<b>4. INSTRUMENTAL CERTIFICATE</b>		
a. Vocal/Choral Music K-12 Certificate		
b. Methods/Techniques (strings, bass, woodwinds, percussion) .....		6
c. Applied Major Instrument.....		2
d. Instrumental Ensemble .....		2
e. Advanced Instrumental Conducting.....		2
f. Instrumentation/Arranging .....		2
<b>MINIMUM TOTAL SEMESTER HOURS</b> .....		<b>14</b>

<b>R. PHYSICAL EDUCATION</b>	<b>Grades K-12</b>	<b>Grades K-9</b>	<b>GRADES 9-12</b>
1. History and Philosophy.....	2	2	2
2. Anatomy-Physiology.....	2	2	2
3. Kinesiology .....	2	2	2
4. Physiology of Exercise .....	2	2	2
5. Measurement and Evaluation .....	2	2	2
6. Health Related Fitness/Wellness.....	4	2	2
7. Lifetime Activities and Dance .....	7	2	5
8. Adapted Physical Education .....	2	2	2
9. Psychological Aspects of Physical Education .....	2	2	2
10. Sociological Aspects of Physical Education .....	2	0	2
11. Motor Development/Motor Learning .....	2	2	2
12. First Aid, CPR and Care of Activity/Sport Injuries .....	2	2	2
13. Movement and Rhythms .....	2	2	0
14. Methods in Physical Education K-4 .....	3	3	0
15. Methods in Physical Education 5-9.....	3	3	0
16. Electives.....	3	0	3
<b>MINIMUM TOTAL SEMESTER HOURS</b> .....	<b>42</b>	<b>30</b>	<b>30</b>

<b>S. SCIENCE</b>	<b>GRADES 9-12</b>
<b>1. BIOLOGY</b>	
a. History/Philosophy of Science and Technology—two (2) semester hours	
b. Twenty (20) hours in Biology which includes:	
1) Cell Biology	



P. SCIENCE (continued)	GRADES 9-12
2) Plant Form and Function 3) Animal Form and Function 4) Genetics 5) Evolution 6) Biology Electives	
c. Ten (10) additional hours in Science which includes: 1) Chemistry 2) Physics 3) Earth Science 4) Environmental Science	
<b>MINIMUM TOTAL SEMESTER HOURS..... 32</b>	
<b>2. CHEMISTRY</b>	
a. History/Philosophy of Science and Technology—two (2) semester hours	
b. Twenty (20) hours in Chemistry which includes: 1) Inorganic Chemistry 2) Analytical Chemistry 3) Organic Chemistry (Lect-Lab) 4) Physical Chemistry 5) Biochemistry 6) Chemistry Electives	
c. Ten (10) additional hours in Science which includes: 1) Physics 2) Biology 3) Earth Science 4) Environmental Science	
<b>MINIMUM TOTAL SEMESTER HOURS..... 32</b>	
<b>3. EARTH SCIENCE</b>	
a. History/Philosophy of Science and Technology—two (2) semester hours	
b. Twenty (20) hours in Earth Science which includes: 1) Astronomy 2) Meteorology 3) Geology/Physical Geography 4) Earth Science Electives	
c. Ten (10) additional hours in Science which includes: 1) Chemistry 2) Biology 3) Physics 4) Environmental Science	
<b>MINIMUM TOTAL SEMESTER HOURS..... 32</b>	
<b>4. GENERAL SCIENCE</b>	
a. History/Philosophy of Science and Technology—two (2) semester hours	
b. Thirty (30) hours in Science course work which includes: 1) Chemistry (Lect-Lab) 2) Biology (Lect-Lab) 3) Physics (Lect-Lab) 4) Earth Science 5) Astronomy	

<b>S. SCIENCE (continued)</b>		<b>GRADES 9-12</b>
6) Environmental Science		
<b>MINIMUM TOTAL SEMESTER HOURS.....</b>		<b>32</b>
<b>5. PHYSICS</b>		
a. History/Philosophy of Science and Technology—two (2) semester hours		
b. Twenty (20) hours in Physics course work which includes:		
1) Mechanics		
2) Electricity and Magnetism		
3) Heat, Sound, and Light		
4) Atomic or Modern Physics		
5) Physics Electives		
c. Ten (10) additional hours in Science which includes:		
1) Chemistry		
2) Biology		
3) Earth Science		
4) Environmental Science		
<b>MINIMUM TOTAL SEMESTER HOURS.....</b>		<b>32</b>
<b>Note:</b> The Environmental Science requirement may also be met by such courses as Basic Ecology, Environmental Geology, Human Ecology, or Social Biology.		
<b>T. SOCIAL SCIENCE</b>		<b>GRADES 9-12</b>
1. U.S. History.....		12
2. World History .....		8
3. Political Science (State and U.S. Government).....		6
4. Economics .....		3
5. Geography .....		3
6. Behavioral Science (Sociology, Anthropology, or Psychology).....		6
7. Elective Social Studies .....		0-2
<b>MINIMUM TOTAL SEMESTER HOURS.....</b>		<b>40</b>
<b>U. SPEECH AND THEATRE</b>		<b>GRADES 9-12</b>
1. Speech (to include two (2) semester hours in debate).....		12
2. Theatre .....		12
3. Electives (from Speech, Theatre, and/or Mass Communications) .....		6
<b>MINIMUM TOTAL SEMESTER HOURS.....</b>		<b>30</b>
<b>V. UNIFIED SCIENCE</b>		<b>GRADES 9-12</b>
<b>1. BIOLOGY CERTIFICATE</b>		
a. History/Philosophy of Science and Technology .....		3
b. Biology (to include Zoology and Botany with labs).....		8
c. Chemistry (with labs) .....		8
d. Physics (with labs) .....		8
e. Earth Science (to include Geology and Meteorology).....		8
f. Environmental Science.....		4
g. An additional twenty (20) semester hours in Biology to include course work in:		
1) Zoology		5) Microbiology
2) Botany		6) Anatomy and Physiology

<b>S. UNIFIED SCIENCE (continued)</b>		<b>GRADES 9-12</b>
3) Genetics	7) Ecology	
4) Cell/Biochemistry	8) Evolution	20
<b>MINIMUM TOTAL SEMESTER HOURS</b>		<b>59</b>
<b>2. CHEMISTRY CERTIFICATE</b>		
a. History/Philosophy of Science and Technology .....		3
b. Biology (to include Zoology and Botany with labs).....		8
c. Chemistry (with labs) .....		8
d. Physics (with labs).....		8
e. Earth Science (to include Geology and Meteorology).....		8
f. Environmental Science.....		4
g. An additional twenty (20) semester hours in Chemistry to include course work in:		
1) Biochemistry	5) Qualitative Analysis	
2) Organic Chemistry	6) Advanced Analysis	
3) Physical Chemistry	7) Environmental Chemistry	
4) Quantitative Analysis		20
<b>MINIMUM TOTAL SEMESTER HOURS .....</b>		<b>59</b>
<b>3. EARTH SCIENCE CERTIFICATE</b>		
a. History/Philosophy of Science and Technology .....		3
b. Biology (to include Zoology and Botany with labs).....		8
c. Chemistry (with labs) .....		8
d. Physics (with labs).....		8
e. Earth Science (to include Geology and Meteorology).....		8
f. Environmental Science.....		4
g. An additional twenty (20) semester hours in Earth Science to include course work in:		
1) Geology/Physical Geography	4) Paleontology	
2) Astronomy	5) Oceanography	
3) Meteorology		20
<b>MINIMUM TOTAL SEMESTER HOURS .....</b>		<b>59</b>
<b>4. PHYSICS CERTIFICATE</b>		
a. History/Philosophy of Science and Technology .....		3
b. Biology (to include Zoology and Botany with labs).....		8
c. Chemistry (with labs) .....		8
d. Physics (with labs).....		8
e. Earth Science (to include Geology and Meteorology).....		8
f. Environmental Science.....		4
g. An additional twenty (20) semester hours in Physics to include course work in:		
1) Quantum Physics	5) Optics	
2) Atomic/Nuclear Physics	6) Electricity/Magnetism	
3) Heat/Thermodynamics	7) Statistics/Mechanics	
4) Health Physics		20
<b>MINIMUM TOTAL SEMESTER HOURS .....</b>		<b>59</b>
Techniques/Methods of Teaching Science will include: safety, lab techniques, and research process skills.		
This certificate will allow a teacher to teach any of the beginning sciences (i.e., Biology I or Chemistry I).		
A certificate is required for each area in which an advanced class is taught (i.e., Biology II and Chemistry II).		
<b>W. VOCATIONAL FAMILY AND CONSUMER SCIENCES*</b>		<b>GRADES 9-12</b>
<i>*moved to Family and Consumer Science, K-12, other.</i>		